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DEPARTMENTS.

SOLUTIONS OF PROBLEMS.

ARITHMETIC.

120. Proposed by ELMER SCHUYLER, B. Sc., Professor of German and Mathematics in Boys' High School, Reading, Pa.

How many balls 1 inch in diameter can be put in a cubical box 1 foot in the *clear* each way, putting in the maximum number? [From Greenleaf's *Treatise on Algebra.*]

Solution by G. B. M. ZERR, A. M., Ph. D., Professor of Mathematics and Science, Chester High School, Chester, Pa., and the PROPOSER.

First, put in two layers of 144 balls each, then fourteen layers of 121 and 144 balls in alternate layers.

This gives nine layers of 144 each=1296
seven layers of 121 each= 847

Total=2143

Every four balls in 144 layer makes with each ball in a 121 layer a square pyramid, base 1 inch, and slant edge 1 inch.

$\therefore$ Altitude $=\frac{1}{2}\sqrt{2}=.7071$ inches.

$.7071\times14=9.8994$ inches. $9.8994+2=11.8994$ inches.

$12-11.8994=.1006$ inch to spare.

Also solved by *CHARLES C. CROSS.*

121. Proposed by PAUL ROULET, A. M., Professor of Mathematics, Fairmount College, Wichita, Kas.

Three men, named Adams, Morris, and Stoughton, with their sons, Edward, Nathan, and Walter, have each a piece of land in the form of a square. Mr. Adams' piece is 23 rods longer on each side than Nathan's, and Mr. Stoughton's piece is 11 rods longer on each side than Edward's. Each father has 63 square rods of land more than his son. Which of these persons is father and son, respectively?

I. Solution by M. A. GRUBER, A. M., War Department, Washington, D. C.

Let the initial letter of person's name represent the length of the respective person's square piece of land.

Then $63+E^2=\square$, $63+N^2=\square$, and $63+W^2=\square$.

We are now to find which of these squares equals, respectively, A^2, M^2, and S^2.

The basis of work is the identity,

$$mn+\left(\frac{m-n}{2}\right)^2=\left(\frac{m+n}{2}\right)^2,$$

where $mn=63=9\times7=21\times3=63\times1$.

From these sets of factors of 63, we obtain